Claims

1. A method for aligning individually moved sheet-shaped materials comprising the steps of:

a) accepting the sheet-shaped material from a first transport unit using a first frictional wheel (A) and a second frictional wheel (B), wherein the first and second frictional wheels (A, B) are independently driven;

b) rotating the sheet-shaped material in a first phase in a first direction of rotation by controlling the angular velocities of the first frictional wheel (A) and of the second frictional wheel (B), wherein at the beginning and end of the first phase the angular velocities of the first and second frictional wheels (A, B) are about the same;

c) rotating the sheet-shaped material in a second phase in a second direction of rotation opposing the first one by controlling the angular velocities of the first frictional wheel (A) and of the second frictional wheel (B), wherein at the beginning and end of the second phase the angular velocities of the first and second frictional wheels are about the same;

d) delivering the aligned sheet-shaped material to a second transport unit.

2. A method according to Claim 1 further comprising the step of controlling the first and second frictional wheels as a function of one or more state parameters input angle(φ_{in}), output angle(φ_{out}), input speed(v_{in}), output speed(v_{out}), X shift (x_{shift}) and Y shift (y_{shift}) of the sheet-shaped materials.

3. A method according to Claim 2, wherein the step of controlling the first and second frictional wheels is carried out for each individual sheet-shaped material.

4. A method according to Claim 2, wherein the step of controlling the first and second frictional wheels is carried out using a look-up table.

5. A method according to Claim 1 further comprising the step of controlling the first and second frictional wheels as a function of the center of gravity of the sheet-shaped material.

6. A method according to Claim 2, wherein the input angle (φin) and the output angle (φout) differ by about 90°.

7. A method according to Claim 1, wherein at least one of the frictional wheels (A, B) changes direction.

8. An apparatus for aligning individually moving sheet-shaped materials between an input transport device and an output transport device comprising:

a first frictional wheel (A) and a second frictional wheel (B) for accepting the sheet-shaped material from the input transport device;

drivers for driving the first frictional wheel (A) and a second frictional wheel (B);

a controller for controlling the first and second frictional wheels drivers to: a) rotate the sheet-shaped material in a first phase in a first direction of rotation by controlling the angular velocities of the first frictional wheel (A) and of the second frictional wheel (B), wherein at the beginning and end of the first phase the angular velocities of the first and second frictional wheels (A, B) are about the same; b) rotate the sheet-shaped material in a second phase in a second direction of rotation opposing the first one by controlling the angular velocities of the first frictional wheel (A) and of the second frictional wheel (B), wherein at the beginning and end of the second phase the angular velocities of the first and second frictional wheels are about the same.

9. An apparatus according to claim 8, wherein the first and second frictional wheels are controlled as a function of one or more state parameters input angle(φ_{in}), output angle(φ_{out}), input speed(v_{in}), output speed(v_{out}), X shift (x_{shift}t) and Y shift (y_{shift}) of the sheet-shaped materials.

10. An apparatus according to Claim 9, wherein controlling the first and second frictional wheels is carried out for each individual sheet-shaped material.

11. An apparatus according to Claim 9, wherein controlling the first and second frictional wheels is carried out using a look-up table.

12. An apparatus according to Claim 8, wherein the first and second frictional wheels are controlled as a function of the center of gravity of the sheet-shaped material.

13. An apparatus according to Claim 9, wherein the input angle (φin) and the output angle (φout) differ by about 90°.

14. An apparatus according to Claim 8, wherein at least one of the frictional wheels (A, B) changes direction.

15. An apparatus according to Claim 8, wherein the drivers are stepper motors.